Challenges to accomplish carbon neutrality in the Helsinki Metropolitan Area by 2050

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Abstract

Cities are key actors in global and country level climate mitigation efforts. Many cities around the world are committed to significantly reducing greenhouse gas (GHG) emissions through climate strategies including carbon neutrality. The City of Helsinki and the Helsinki Metropolitan area (Helsinki, Vantaa, Espoo, and Kauniainen) intend to become carbon neutral by 2050. However, accomplishing this goal poses a core set of challenges. Political issues within the city government, poor co-operation among the cities, and the slow development of carbon reduction actions in two or three metropolitan cities are the dominant challenges for the achievement of carbon neutral goal. The cities are usually weakened due to the limited power to raise the revenues to finance infrastructures investments and programmatic actions for climate change adaptations and mitigations. They also face limitations on the consistency and comparability of energy and emissions data due to jurisdictional and administrative boundaries. Helsinki Metropolitan area is comprised of four municipalities creating challenges in agreeing upon integrated approaches to climate mitigation agendas to combat climate change and implement carbon neutral target by 2050. We extracted several sectorial and citywide carbon emissions and emission production rates ($MtCO_2e$, $KgCO_2e$/inhabitant) from the online databases, re-calculated them, and constructed tables and graphs to show the development of emission reductions in each city in the Helsinki Metropolitan area. Then, we studied various factors that intervene on the development of emission reduction actions and implementation of climate strategies through interview methods. We also interviewed several energy and climate experts from various environmental institutions and city officials to recognize the challenges for carbon neutral targets. Cities in Helsinki Metropolitan area produce 43.8 % emissions from DH, 26.9 % emissions from transport, 12.5 % emissions from electricity consumption, and 12.9 % emissions from electricity and separate heating from their total emissions production. Thus, reducing emissions from these sectors is vital. Robust implementation measures to include energy transition to clean energy development, awareness programs, and citizen engagements to climate actions are vital to achieving the carbon neutral target by 2050. Strong political commitments from central government and city councils in Helsinki area is required to collaborative climate actions to accomplish the carbon neutral target.

1. Introduction

Carbon emission causes global warming leading to climate change which is harmful to natural environment and biodiversity. The artificial carbon emissions come from energy utilities, public and private buildings, transportation systems, and other human activities such as agriculture, farming, waste and water treatments, and other industrial activities. The increase of emissions is not only a threat to environment but it also poses a huge challenge for local and regional governments to control it. Reduction of carbon emissions is imperative to stop the trend of climate change (IPCC, 2014). Cities' well-defined climate strategies are effective measures to reduce the carbon emissions (Onaja; Dibua & Enete, 2011). As the concern over the global warming and climate change are rising, formulation and implementation of stringent policy measures and adoption of new and realistic carbon reduction techniques are essential. Carbon emissions can be reduced by various means such as establishing renewable energy sources, manipulating the best available techniques (BATS)

at source of emissions, regulating environmental policies in the right and appropriate manner, and innovating new solution methods (Dahal & Niemelä, 2016).

Cities are vital in the fight to reduce GHG emissions as more than 70 % of global energy-induced emissions are generated in cities (Fong & Schleeter, 2014). Such carbon emissions are under the control of cities. Thus, cities have opportunities to reduce significant emissions through their robust climate adaptation measures. Carbon neutral city means that total carbon production in the city should not be exceeded more than total carbon consumption in the surrounding atmosphere (Dahal & Niemelä, 2016). The Helsinki Region Environmental Services Authority (HSY) is a municipal body in the Helsinki metropolitan area intended to build the metropolitan area carbon neutral by 2050 (Dahal & Niemelä, 2016). The Helsinki Metropolitan area includes four cities: Helsinki, Espoo, Vantaa, and Kauniainen.

The average temperature in Finland has risen by more than 2^0 C over the past 166 years (University of Eastern Finland, 2014). The cities in the arctic area are particularly affected by this problem. Thus, their initiations towards the mitigation of this rising temperature and climate change are critical. The cities in Helsinki Metropolitan area have established their independent as well as joint climate strategies for reducing significant emissions by 2020, 2030 and 2050 according to EU and Finnish government's climate policies (Dahal & Niemelä, 2016). However, these strategies are challenging to accomplish because of various reasons. The current energy and transportation systems and energy consumption practices are required to change to lower the significant carbon emissions but these actions are very challenging to realize in practice. The renewable energy production, development of clean energy technologies, implementation of robust climate strategies all require strong effort from the all societal groups.

Changes in climatic patterns in Helsinki region, as well as entire Finland, have been clearly observed such as changes in snowfall time, drought and warm winter, rainy summer, changes in Baltic Sea ice and declining of snow cover (NSIDC, 2012). On the contrary, development of clean and renewable energy systems and carbon emissions reduction measures in many other Nordic cities such as Copenhagen and Stockholm are competitive (Nordic Council of Ministers, 2011) which urges Helsinki metropolitan cities to reinforce its carbon neutral measures. Various environmental and climate institutions have been pressuring central governments, city administrations and energy industries to reduce carbon emissions (Dahal & Niemelä, 2016). Global initiatives and agreements to climate actions also push the government and the cities to act on the carbon neutralization and other climate mitigation actions. For instance; Finland took part in the Paris climate conference held in December 2015 in Paris, France which entails reduction of global temperature to well below 2 ^{0}C (European Commission, 2015), (Dahal & Niemelä, 2016). This agreement also impulses the Finnish government as well as cities to enact dynamically to reduce carbon emissions. These dynamic factors are the drivers for the cities in the Helsinki Metropolitan area to adopt strict carbon cutting measures to establish carbon neutrality.

The City of Helsinki has developed a road map to become carbon neutral by 2050. It has also started implementing emissions reducing measures specified in the road map. However, implementation of these measures is not easy as various political, economic, and social factors are affecting to implementation process. Other cities in the Helsinki Metropolitan area have also committed to reducing significant emissions (up to 80 %) by 2050 but their climate strategies are not strong enough to reach the targets and to establish carbon neutral Helsinki Metropolitan area by 2050 (Dahal & Niemelä, 2016). In addition, many other administrative, economic, and social causes have posed challenges to establish carbon neutral Helsinki Metropolitan area by 2050. This paper explores these factors and how they are challenging the establishment of carbon neutrality. The paper also explores solutions for such challenges. To show the emissions reduction change, we also present the current development and future emissions projection data in the Helsinki Metropolitan area. To do so, we analyze sectorial and citywide carbon emissions amounts and emission production rates ($MtCO_2e$,

$KgCO_2e$/inhabitant) from online database. We also conducted interviews to recognize the factors which challenge to the development of emission reduction actions and implementation of climate strategies.

2. Methods

We collected emissions data from Helsinki environmental statistics which is managed by the City of Helsinki Environmental Centre. We extracted several sectorial and citywide carbon emissions and emission production rates ($MtCO_2e$, $KgCO_2e$/inhabitant) from this online database system, recalculated them to identify emission reduction rates, and constructed tables to illustrate the development of emission reductions in each city in the Helsinki Metropolitan area. Then, we compared and analyzed eight different sectoral emissions data of all four cities (Helsinki, Espoo, Vantaa, Kauniainen) in a chart (Figure 1) and emission reduction rates of all four cities in a table (Table 1). We then compared the emission projections of the City of Helsinki and entire Helsinki Metropolitan area (Table 2) to differentiate emissions reduction progresses of these two frontiers as they both have envisioned to become carbon neutral by 2050.

We also conducted four semi-structured interviews with the experts in energy and climate field from the Helsinki Metropolitan area to understand current and future emissions reduction strategies and action plans. In addition, we conducted a semi-structured interview with a climate expert in the City of Copenhagen to understand the carbon reduction and climate strategies in the City of Copenhagen as it has a goal to become carbon neutral by 2025. We explored various factors that intervene on the development of emission reduction actions and implementation of climate strategies through interview methods. We used these various sources in order to increase our level of understanding on the climate actions to reduce emissions and challenges to implement such actions.

3. Results

3.1 Current situation of sectoral carbon emissions in the four cities

Figure 1 illustrates the current sectoral total carbon emissions situations in all cities in the Helsinki Metropolitan area. According to the current emissions accounting system adopted by the cities in Helsinki Metropolitan area, carbon emissions have been calculated from 8 different sectors; district heating, separate heating, electric heating, electricity consumption, transport, industry and machinery, treatment of waste and wastewater and agriculture (Figure 1).

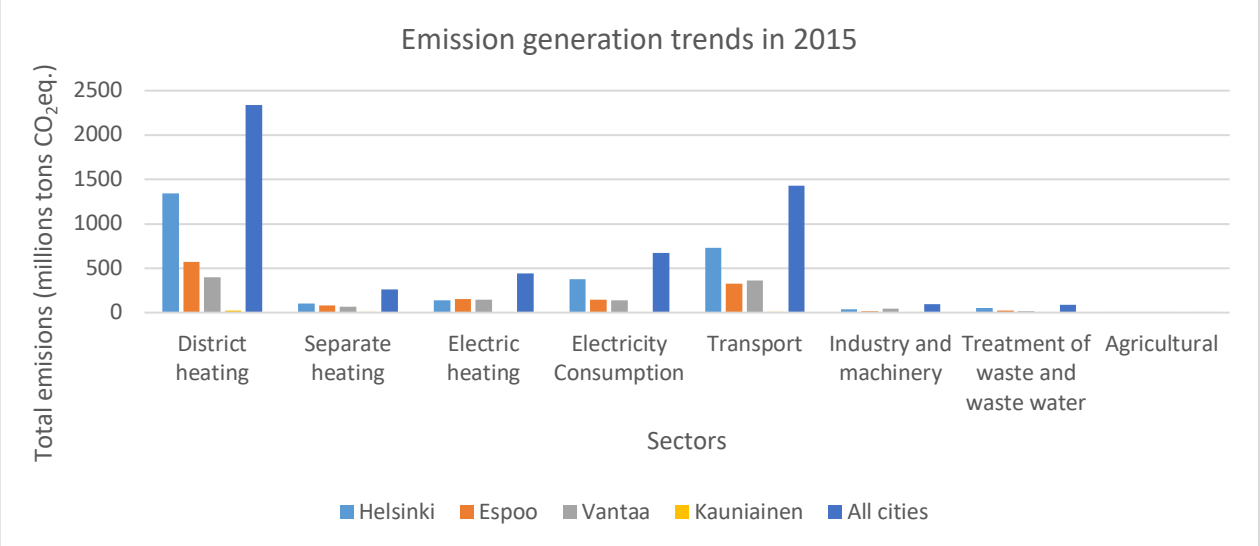

Figure 1: Total emission production from different sectors in the cities in Helsinki Metropolitan area in 2015 (Helsinki Environmental Centre, 2015)

All four cities possess three prominent sectors (district heating (DH), transportation, and electricity consumption) for emissions production. Electric heating and separate heating sectors also produce significant amount of carbon emissions. However, other three sectors do not generate massive emissions. The City of Helsinki produces 48.2 % emissions from DH, 26.3 % from transport, 14 % from electricity consumption, and 8. 6 % from electricity and separate heating from its total emissions production. Similarly, all cities produce 43.8 % emissions from DH, 26.9 % emissions from transport, 12.5 % emissions from electricity consumption, and 12.9 % emissions from electricity and separate heating from their total emissions production.

3.2 Emission reduction rates

Table 1 shows per capita emissions reduction rates in the cities in Helsinki Metropolitan area for each 5-year intervals during 2000-2015. All emission reductions are compared with the emissions level in 1990.

Table 1: Per capita emissions reduction rates in four cities during 1990-2015

Per capita emission reductions (%)				
City	2000	2005	2010	2015
Helsinki	19%	16%	25%	40%
Espoo	2%	2%	13%	21%
Vantaa	3%	+3%	4%	22%
Kauniainen	+12%	+23%	+11%	+13%
Total	13%	10%	19%	17%
+ sign indicates increase of emissions				

Note: These numbers were calculated from the emissions data in the Helsinki environmental statistics

While emissions reduction activities have been taking place in the cities in Helsinki Metropolitan area since the 1980s, actual emission reduction activities seem to have started after the climate strategies formulated in 2007 (Dahal & Niemelä, 2016). Except for the city of Kauniainen, all other cities have reduced per capita emissions during 25 years by 21-40 %. The City of Kauniainen is increasing its emissions all the time instead of reducing.

The City of Helsinki reduced 19 % per capita emissions in 2000 but this reduction rate could not continue and the emissions level increased again during 2000-2005. Its emissions reduction rate is continuously increasing even after the implementation of climate strategy in 2007. The same principle applies to other two cities; Espoo and Vantaa as well. However, both the cities' emissions reduction rates remained same during 2000-2005. Currently, per capita emissions reduction in the City of Helsinki is 40%, the City of Vantaa is 22 5%, and the City of Espoo is 21%. The City of Kauniainen increased 13% per capita emissions in 2015 as compared to emissions level in 1990. By considering these data, City of Helsinki is executing its climate action plans quite well and the City of Kauniainen has not made much efforts to reduce its carbon emissions. The City of Espoo and the City of Vantaa seems to have started progressing their climate works in recent years.

3.3 Future projections for emission reduction

The City of Helsinki aims at reducing carbon emissions by 30% by 2020 and intends to be carbon neutral by 2050 (Dahal & Niemelä, 2016). It also aims to achieve a 20% energy efficiency improvement by 2020 compared to 2005 and to increase the share of renewable energy sources to least 20% by 2020 (Dahal & Niemelä, 2016). The City of Vantaa has committed itself to an 80% total carbon reduction by 2050, but the cities of Espoo and Kauniainen have not defined such targets (Dahal & Niemelä, 2016). The targets set for total emissions reduction in the Helsinki Metropolitan area by HSY stand at 20% by 2020 and a

39% reduction per capita by 2030 (Dahal & Niemelä, 2016). All emissions are compared with the emissions measurements in 1990.

Table 2: Emissions scenarios and projections for the City of Helsinki and Helsinki Metropolitan area

CO_2 emissions scenarios and projections

City of Helsinki	1990	2015	2020	2050
Per capita emissions (kg/resident)	7 300	4 410	3 900	400
Per capita emission reduction (%)	-	39.92	47	94-100 (C.N.)[1]
Total emissions (millions kg)	3.69	2.77	2.58	0.288
Helsinki Metropolitan area	1990	2015	2030	2050
Per capita emissions (kg/resident)	7 200	4 740	4 282.2	C.N.[1]
Per capita emission reduction (%)	-	16.81	39	100
Total emissions (millions kg)	5.96	5.33	-	C.N.[1]

Note: These numbers were calculated from the emissions data in the Helsinki environmental statistics

The actual projection for per capita carbon reductions for the City of Helsinki stands at 94%, with the total emissions set to reach a reduction of 92% by 2050 (Dahal & Niemelä, 2016). The respondents from the City of Helsinki say that the city is considering to sequester the rest 5-6 % carbon emissions from forest sink, green spaces and carbon capture and sequestration process. The City of Helsinki has further projected a per capita carbon emissions reduction to 3900 kg per resident (–47%) by 2020 and 400 kg/resident (94%) by 2050, with total emissions dropping to 2.58 million (–30%) by 2020 and 288,000 tons (–92%) by 2050 (Dahal & Niemelä, 2016). The City of Helsinki reduced per capita carbon emissions to 39.9% as of 2015, decreasing the carbon burden to 4410-kg/resident from the 1990 level of 7300 kg/resident (Table 2). Total emissions have decreased by 24.8% from 3.7 million kg CO_2 to 2.77 million kg CO_2 during the same time period. Similarly, the entire metropolitan area has achieved a 34.2% reduction in per capita carbon emissions from 7200 kg/resident in 1990 to 4740 kg/resident in 2015 (Table 2), decreasing total emissions by 10.6% from 5.96 million kg CO_2 to 5.33 million kg CO_2in the same period (Table 2).

Per capita emissions for the City of Helsinki as well as the entire metropolitan area have decreased significantly, approaching goals. However, the total emissions reductions for the metropolitan area remain far behind the target set for 2020—that is, total emissions have decreased only by 10.6% between 1990 and 2015. The City of Helsinki has reduced total emissions by three-fourths during the same period and close to 30% of the carbon reduction target to be reached by 2030.

The information obtained from interviews reveal that even though HSY envisions reaching a carbon neutral Helsinki Metropolitan area by 2050, it does not yet have descriptive reduction measures in place. Clear targets for the metropolitan area only exist for total emissions reductions by 2020 and per capita carbon emissions reductions by 2030 (Table 2). This indicates that the carbon neutrality goals of the metropolitan area are weaker than those for the City of Helsinki. Current scenarios show that the carbon reduction goals for the City of Helsinki can be realized if carbon reduction activities materialize a little faster than they currently are, while reaching the goals of the metropolitan area appears unlikely if additional measures are not taken. According to the respondents from the City of Helsinki, the City has planned several emissions reduction construction projects such as a new rail

[1] C.N. = Carbon Neutral

link for replacing buses and new metro rail constructions. If these projects are implemented as soon as possible, significant emissions reduction is possible from transportation sector in the coming years.

3.4 Factors challenging the achievement of the goals

Multiple challenges are arising to implement the climate strategies as the cities proceed to ambitious goal to become carbon neutrality by certain deadline (by 2050). Reduction of significant carbon emissions from various sources requires proper planning, robust policy measures, established data and measurement systems, inclusive government, proper budgeting, community participation, and cooperation with the various national and international business partners. The cities may also have political issues within the city government and with the inter cities governments as well. According to the respondents, the cities in Helsinki area also have political issues as city administrative are elected from different political parties which have different views about the climate policies. Emissions reduction strategies for climate change adaptation and mitigation are often expensive. The respondents consider that this has been challenges for metropolitan cities, especially for larger construction projects. Cities may also face obstacle for the use of national and international funding, independent formulation and implementation of climate policies, and energy and emission data acquisition. Cities generally have limited access to international climate change negotiations and usually compel to follow the national level climate plans. However, respondents say that fortunately cities in Finland are not limited to formulate the climate plans beyond the national level climate strategies but participation in the international agreements is restricted as many other cities around the worlds. Sometimes city leaders' inadequate long-term vision capacities are also challenging for framing and implementing the robust climate goals. Due to the small jurisdictional boundaries of the cities in the Helsinki area, cities face difficulties in measuring and collecting the precise carbon emissions data within the city boundaries. Without standardized emission accounting system and transparent measured emission data, cities cannot categorize the most and the least important emission sources to be addressed for carbon neutrality. The current emission accounting system adopted by the cities in the Helsinki Metropolitan area is based on the IPCC accounting standard which excludes many indirect and consumption-based emissions (Dahal & Niemelä, 2017). However, current emission accounting system identifies major emitting sources are district heating (DH), traffic, and electricity consumption in the cities in the Helsinki Metropolitan area (Figure 1). Thus, significant measures are especially required for these sectors but also challenges remain to integrate renewable mixes to electricity and heating, fuel shifting from fossil fuels to low-carbon fuels, production of bio-oils, and implementing proper building energy efficiency improvement methods.

The prime challenge is the co-operation between the cities in the Helsinki Metropolitan area to frame and implement joint climate strategies because all four cities have different approaches and targets to reduce emissions by 2050. These cities have committed themselves to reducing 39% per capita emissions by 2030 through the joint climate strategy which includes 120 different measures to reduce emissions (Dahal & Niemelä, 2016). Besides this, other joint emission reduction strategies have not been outlined yet. Development and management of transportation in the smart and intelligent ways in these cities are somewhat challenging due to the various issues such as infrastructure planning, inter cities coordination, and budgeting. The development and management of intra and inter-city transportation infrastructure in the Helsinki Metropolitan area are jointly implemented, financed, managed, and regulated by two or more city councils and Helsinki Region Transport Agency (HSL). Co-ordination of these processes relies on complicated inter- city governmental policy systems and administrative management systems. Land use planning for the climate-friendly development, digitalization of energy systems, generation of renewable energy, and waste and water management all require effective financing, inter-city coordination, and integrated policy implementation. The City of Helsinki has achieved satisfying results for emissions reductions but other cities are far behind their targets. A single city's effort does not solve the

issues of achieving carbon neutrality by 2050 in the entire Helsinki Metropolitan area. It poses challenges to other metropolitan cities to reduce significant emissions reduction to compete with the City of Helsinki. On the other hand, the City of Copenhagen, a neighboring capital city, has an ambitious goal to become carbon neutral by 2025 (Dahal & Niemelä, 2017). respondents opinion that if the cities in Helsinki area would like to compete with the timeline for carbon neutrality in the City of Copenhagen, these cities should work a lot more on the carbon emissions reduction activities such as the promotion of the renewable energy productions.

There are a number of other challenges cities may face while implementing the climate plans. For instance; formulation of effective awareness programmes to citizens and emission producers, addressing international capital markets located in the cities which are vulnerable to climate risks, emissions reduction through green logistics methods, emissions reduction in the airports, shipyards and international jurisdictional borders, renewable energy promotive methods (e.g. appropriate financial and incentive measures) and advancement of smart grid systems such as energy storage systems. In addition, climate neutral timeline itself is a big challenge as all cities are not capable of reducing targeted emissions until the set timeline (by 2050). Citizens' rights and responsibilities are also vital for climate adaptation and mitigation processes. It can be also a challenge for cities to assure the citizens' rights while defining their responsibilities for climate change mitigation process in the climate plan. For instance, Helsinki climate plan includes the closing of a coal power plant by 2025 and stopping of coal usage in other power plants which can affect the employment of citizens. This may bring challenges to compensate these job losses due to this climate mitigation measure. Another challenge is that the cities have defined the measures to reduce only 80-94 % carbon emissions but they have not defined the measures for reducing rest 6 – 20 % carbon emission reduction yet. This means these cities still need to identify the several other measures to reduce emissions.

3.5 Measures to achieve the goals

The cities in the Helsinki Metropolitan area possesses many opportunities to adopt robust measures to ensure carbon neutrality by 2050. As the major sources of emissions are district heating, transportation, and electricity consumption, the cities can prioritize these sectors to cut significant emissions through various measures. For instance, carbon neutral district heating, small-scale renewable energy production, advancement of electric vehicles and energy storage batteries, construction of metro rails, bicycle lanes, and tram tracks and carbon neutral campaigns. Integration of renewables into the DH network, replacement of oil boilers and fossil fuels with clean fuels, and switching coal fuel to other clean fuels in the power plants are some strategies that can help to create carbon neutral DH. The involvement of citizens, public and private institutions and investors, and non-governmental organizations and communities to formulate and implement climate strategies is also crucial. Thus, cities can invite them to participate in the carbon emissions reduction processes. The climate plan can include strong economic measures to provide sustainable economic opportunity for all residents. It can plan for sustainable transportation system to provide easy access to all citizens from their living and working locations. Cities can also increase the investment budgets for carbon emissions reduction and climate change mitigation measures.

The cities can adopt compulsory building codes and lawful zoning for the construction of climate friendly buildings and smart towns. The voluntary building codes and effective zoning for the construction of smart towns (e.g. Kalasatamaa smart town) have been established in the City of Helsinki but other cities in the Helsinki Metropolitan area have not adopted such methods yet. In fact, inviting housing companies' owners to participate in the climate strategy formulation and implementation programs can help construction and retrofit of climate friendly buildings. In addition, cities can use building automation system (BACS) and building cap and trade system to reduce emissions from the building sector. Cities can also set short-term climate plans (for e.g. 3-year, 5-year, and 10-year climate plan). The City of Helsinki has established 3 year- and 5- year climate plan along with its main climate plan to be carbon

neutral by 2050. However, other cities have not formulated such plans. As the metropolitan area lacks enough land spaces, cities can prioritize small-scale renewable energy (solar, geothermal, and wind energy) production in the public and private buildings. The climate plan can clearly state certain percentage of energy production from solar, geothermal, and wind energy which promotes the renewable energy production. The cities can formulate worthy financial mechanisms including subsidies and incentives for the promotion of renewable energy and other energy efficiency measures. The cities can also reduce carbon emissions from growing carbon sinks such as green spaces and forests to complement carbon emissions reduction to carbon neutrality. They can also do it with carbon capture and sequestration (CCS) methods if they have enough budgets or financial supports from the central government or international organizations. The cities can also reduce emissions by compensation method i.e. they can reduce emissions somewhere else to compensate the emissions reduction amount for the cities. For instance; the City of Copenhagen reduces about 30% emissions by this method (Dahal & Niemelä, 2016). However, this method of reducing emissions is not much appreciative as it does not reduce the emissions within the city boundaries.

Cities can also adopt environmental management systems (EMS) to be implemented in the various businesses, offices, and companies. In fact, City of Helsinki has implemented ISO 14001 and EcoCompass system for the environmental management in various organizations (City of Helsinki Environmental Centre, 2014). Other cities in the Helsinki Metropolitan area can also adopt such environmental management systems. The cities can utilize design tools to identify solar potential, wind speeds, geo-heat potentials, green and non-green areas, roads and other land infrastructures, and building settings so that real climate issues are identified and practical solutions can be implemented easily. The City of Helsinki and HSY have started to use such tools nowadays which is a good indicator for carbon neutrality. The city officials can make numerous important decisions regarding climate change adaptations through both the quantitative data analyses and qualitative performance metrics. About 20 cities around the world have committed to reducing more than 80 % emissions including carbon neutral goals (CNCA, 2015). The cities in Helsinki Metropolitan area can also take advantages of these cities' activities on the carbon neutrality and climate change mitigation strategies and action plans through the case study methods. Likewise, cooperation between the cities and private investors and businesses is also vital to implement the climate plan. Most importantly, regional co-operation, especially among the four metropolitan cities, is vital to formulate and implement the carbon neutral action plans. In addition, strong political commitments from the national level political organizations and governments are also vital to build carbon neutral cities.

4. Conclusion and Future Work

This study shows that a number of challenges and opportunities exist to accomplish the goal of achieving carbon neutral Helsinki by 2050. The biggest challenge is the slow development of emissions reduction rates in the cities in the Helsinki Metropolitan area, especially in the Cities of Vantaa and Espoo. The City of Kaunianen holds small part of the emissions produced in the entire metropolitan area but it has increased its emissions level all the time which is not a good indication for carbon neutrality. The City of Helsinki is progressing for carbon emissions reduction but it is possible to improve the current emission reduction rate through various strong climate policy measures and renewable energy production methods. The cities' regional cooperation for formulating and implementing climate strategies has become another challenge for carbon neutrality in the Helsinki Metropolitan area. Establishment of weak regional emissions reduction targets is also a challenge to achieve carbon neutral goal. In addition, climate neutral timeline has become a challenge due to the slow development of emission reduction rates.

As the challenges exist, the cities also have opportunities to adopt various carbon emissions reduction measures. Such measures include carbon neutral electricity production and consumption, construction of regional metro rails, tram lines, and bicycle lanes, construction of zero energy buildings, and energy efficiency measures in the buildings. The

cities can adopt various EMS systems and building codes to implement such climate strategies. The Helsinki metropolitan cities can also collaborate with the national and international businesses for the realization of the carbon neutrality. The cities can study other international cities' climate strategies to achieve carbon neutral goals. In addition, the central government can allow these cities to participate in the climate change mitigation agreements in the international meetings. The cities can revise the current climate goals and policies to make it stronger and set new realistic goals and measures to become carbon neutral by 2050. While doing so, cities will be able to establish solid regional cooperation and joint financial measures. In addition, strong political commitments from the different political parties within the city councils are also critical.

There are a number of issues related to carbon neutrality which can be studied further to identify the proper solution methods. For instance; effective financial measures, awareness programs, best available technologies (BATs), appropriate policy measures, and social inclusion. These factors can be studied profoundly to recognize appropriate emissions reduction measures to establish carbon neutral goals in set deadline. In addition, we can also explore how current climate plans can be made more advanced so that many vigorous climate strategies can be realized.

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